Twenty tips for thrust monitoring

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1. The design thrust load on a thrust bearing should not exceed 200 psig (1.38 MPa) active babbitt pressure. An 8 inch (203 mm) Kingsbury thrust bearing has approximately 32 in² ($8^2/2$), or 20,645 mm² of babbitt area. A 9 inch (229 mm) Kingsbury thrust bearing has approximately 40.5 in² ($9^2/2$) or 26,129 mm² of babbitt area.
2. Thrust bearing catalog values run approximately 450 psig. (3.1 MPa) Lab test values are higher. Remember that the bearing is not in a lab; it is in a machine. Alignment is very significant to even the load and avoid fretting.
3. The full load, thrust bearing metal temperature should not exceed 190°F (88°C), at the recommended TC/RTD position of 75% arc and 75% radius and 1/32 inch (.8 mm) behind the babbitt-to-pad/shell interface.
4. Oil recirculation is a high contributor to bad thrust bearing lubrication designs. Get the oil in and *get it out*. Tangential discharge, pumping rings, directed lube and offset ratio should all be considered.
5. Do not use multiple thin shims to set thrust bearings for float, e.g. 300 mils (7.6 mm) of thin shim in oil can deflect 15 mils (.38 mm) due to spongy shims. Single *thick shims* must be used.
6. If most of the rotor cold "bump" thrust floats are in the 15-17 mil (.38-.43 mm) range, adopt a unit standard of +8 mils (.2 mm), active as a normal range for the unit. Let the "inactive" side float.
7. Some OEMs read static balance chamber pressure for overload alarms; others use balance line pressure for alarm. Some use flow; others use differential pressure. Know which system is used.
8. Some OEM's initially "counterbalance" the thrust to the active side when a compressor is new and in perfect seal clearance condition.
9. A machine with triple (3 times) clearance increase on a balance piston has failed thrust bearings.
10. For ≥ 30 mil (.76 mm) thick babbitt thrust bearings, an active deflection of 15 mils (.38 mm) has proven to be good level for the alarm, with a dual voting "automatic" shutdown at 25 mils (.64 mm) deflection.
11. Very few thrust bearings can survive 250°F (121°C) metal temperatures. Few can survive 235°F (113°C).
12. Wet gas, liquid ingestion, or wet steam in a turbines can momentarily deflect a thrust bearing 15 mils (.38 mm) and still recover without damage (distress) to the babbitt. It can also shear coupling keys, impeller keys, blow out steam chest gaskets, etc.
13. Most bearings are designed (API) for 120°F (49°C) oil inlet temperatures. If you operate at 105-110°F (41 to 43°C), you need to allow for cooler fouling to use the 120°F (49°C) limit. Most thrust bearings intermix active and inactive oil flows before reaching the drain or outlet line temperature indicator.
14. As a predictive correlation tool, consider that if:
    (1) the thrust bearing is 20+ mils (.51 mm), 5 mils (.13 mm) past alarm, but not yet to trip
    (2) the balance chamber pressure has increased 20 psig (138 kPa) at the same load
    (3) the actively-loaded thrust bearing shows metal temperature at 230°F (110°C) from an initial value of 190°F (88°C) a planned shutdown is ***definitely justified!***
15. While the self-leveling links are generally designed for 5-7 times the babbitt thrust rating, they should be inspected at each available incident for fretting under the pads.
16. Compressors in surge can fail thrust bearings due to "cavitation" (fast repetitive establishing of an oil film if axial oscillations occur). One solution is "directed" lube design. Leading oil grooving *may* have the same success.
17. "Frosting" on thrust bearings can occur due to improper welding procedures around machines. Electricity will seek out the closest clearance for the electromagnetic charge to dissipate to earth. The closest clearance is the thrust bearing clearance.
18. The use of synthetic oils may necessitate increased flow and more cooling.
19. Do not put TC/RTDs into the babbitt (white metal).
20. **Don't try to save a thrust bearing on thrust shutdown limits. Save the machine.**

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Mr. Jackson will join Donald E. Bently, Dr. Agnes Muszynska and the Bently Rotor Dynamics Research Corporation staff as a presenter during the Advanced Machinery Dynamics Course August 22-26 in Lake Tahoe, Nevada.